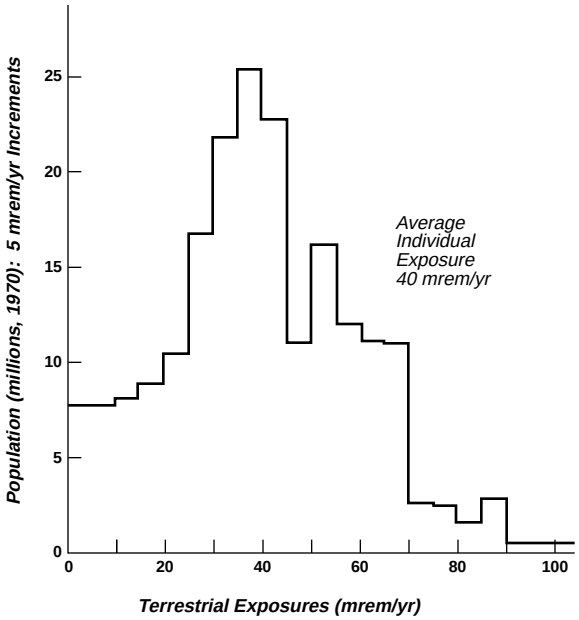
RADIATION EXPOSURE

The ways in which our everyday exposures to ionizing radiation are handled in the section entitled *Ionizing Radiation: Sources and Exposures* requires some explanation. The principal source of information in this section is the National Council on Radiation Protection and Measurement's (NCRP's) *Report No. 93, Ionizing Radiation Exposure of the Population of the United States*, but other important sources of information have also been consulted and appear in the reference list of the section on biological effects. One very important reference on natural radiation exposure not in that list but used by definitive sources on the subject is a doctoral thesis performed under the auspices of the U. S. Environmental Protection Agency by D. T. Oakley at Harvard University, *Natural Radiation Exposure in the United States, EPA Report ORP/SID 7201*, Washington, DC, 1972. According to Oakley, the average individual exposure from terrestrial radiation in the mainland United States, not corrected for self-shielding, is 40 mrem per year (see figure at left).

MAINLAND U.S. POPULATION DISTRIBUTION VERSUS ANNUAL TERRESTRIAL RADIATION EXPOSURE



Source: Adapted from the National Research Council: Committee on the Biological Effects of Ionizing Radiation (BEIR III) The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, 1980.

To obtain the average exposures, natural sources of ionizing radiation are handled in a variety of ways. Cosmic radiation is usually reduced by 10% to account for building shielding and to account for the fact that people spend a lot of time in buildings. Average terrestrial radiation in *NCRP Report No. 93* is 28 mrem/yr, reduced by 30% from 40 mrem/yr to take into account body self-shielding. It is also assumed that exposure to terrestrial shielding is the same outside and inside buildings. (In *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation*, The National Research Council Committee on the Biological Effects of Ionizing Radiation, BEIR III, assumes a 20% reduction for building shielding and an additional 20% for body self-shielding.) The 200 mrem per year individual exposure attributed to radon requires a special explanation. The part of the body exposed to radon and its decay products is, of course, the upper part of the respiratory system, and the 200 mrem for radon in the table and represented in the pie chart is a whole-body exposure. It is estimated by the NCRP that a 200 mrem whole-body exposure poses the same health risk to the body (i.e., the same risk of a fatal cancer) as that posed by actual exposure of the upper respiratory system to radon and its decay products.

Similarly, for inclusion in the exposure table, where only a part of the body is exposed, a whole-body exposure giving the same cancer risk as the actual exposure is the number used. For example, the numbers given for the various exposures to manmade radiation sources are real or calculated whole-body exposures.

The number given for the average annual exposure to building materials (i.e., the buildings we live and work in) is 7 mrem. Definitive information that differentiates the exposures from stone, brick, and wood houses is not available. The data on exposures from building materials are fragmentary, widely scattered and sometimes contradictory. Estimates of building exposure are further complicated by the use of gypsum board that contains radioactive elements of the uranium and thorium series. A definitive study on exposures from building materials, of the stature of Oakley's thesis on terrestrial radiation exposure, would appear to be very desirable.